



## The effect of kaolinite on the permeability

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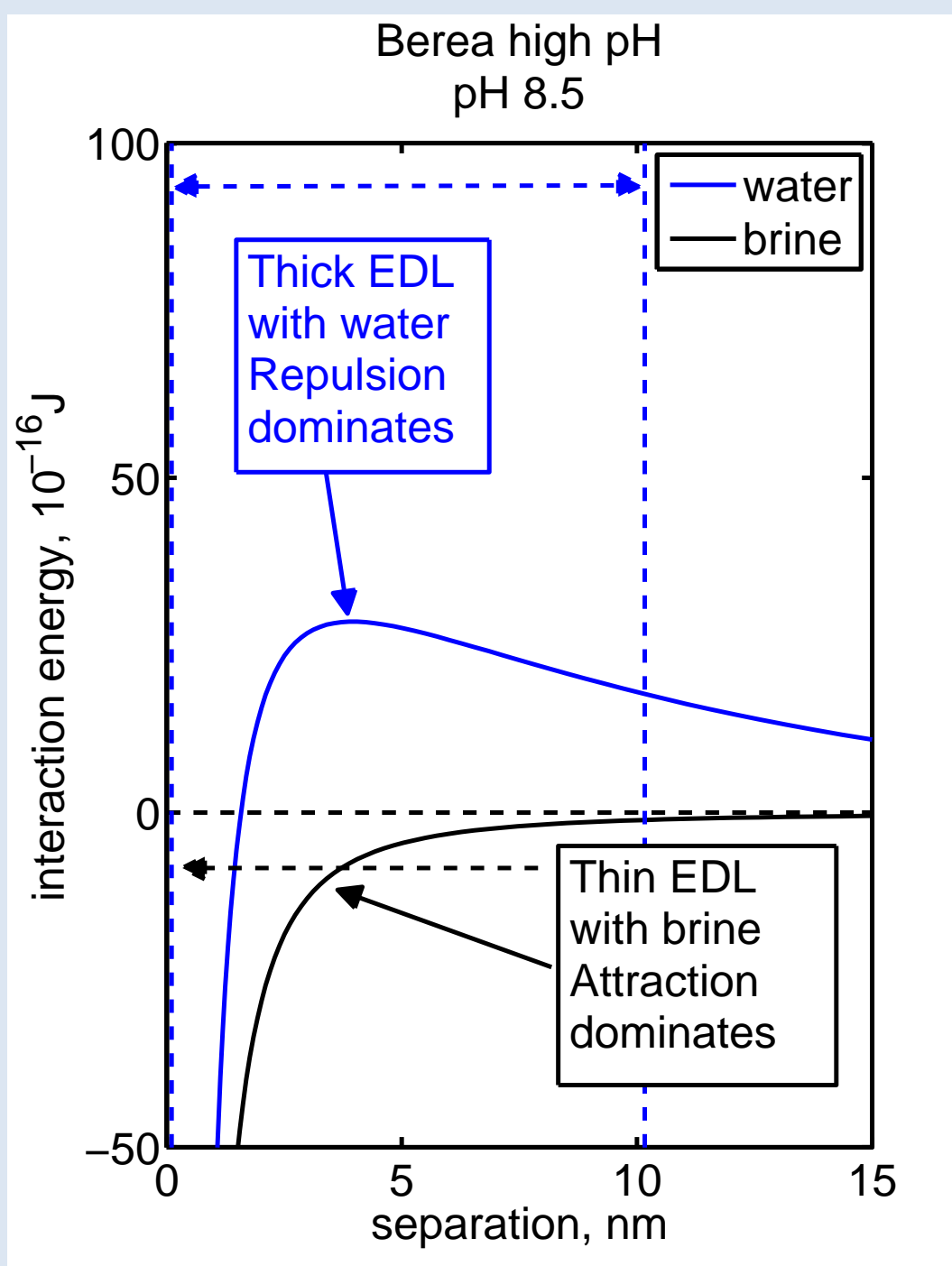
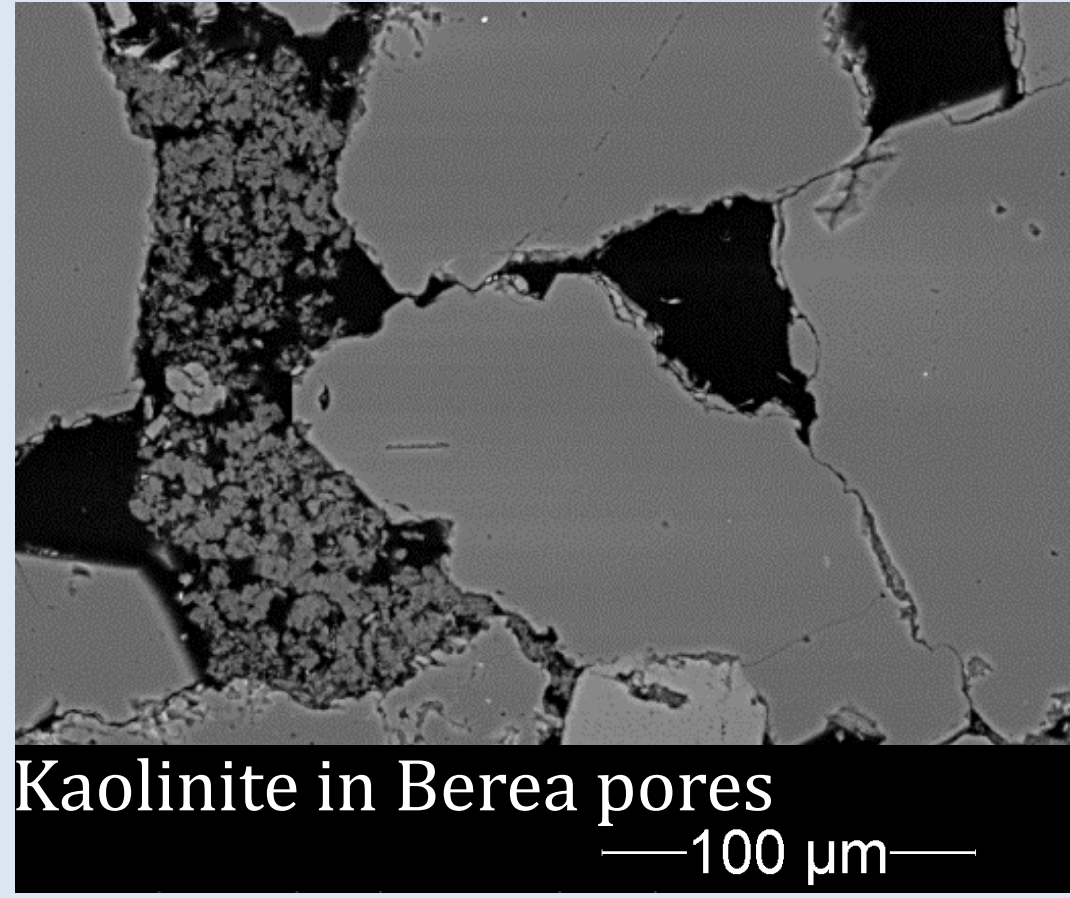
# The effect of kaolinite on the permeability of the Gassum sandstone

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## Previous studies on Berea Sandstone

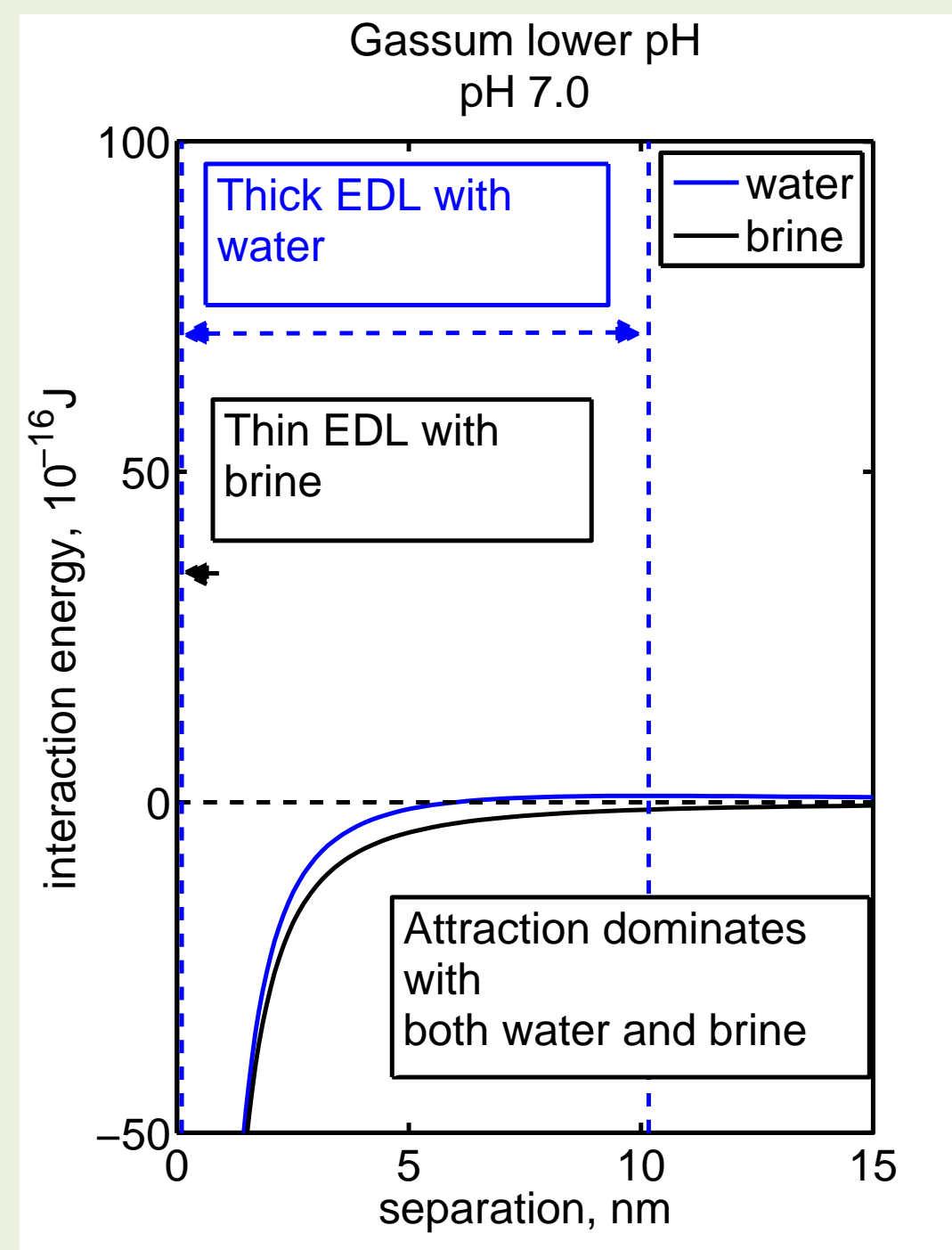
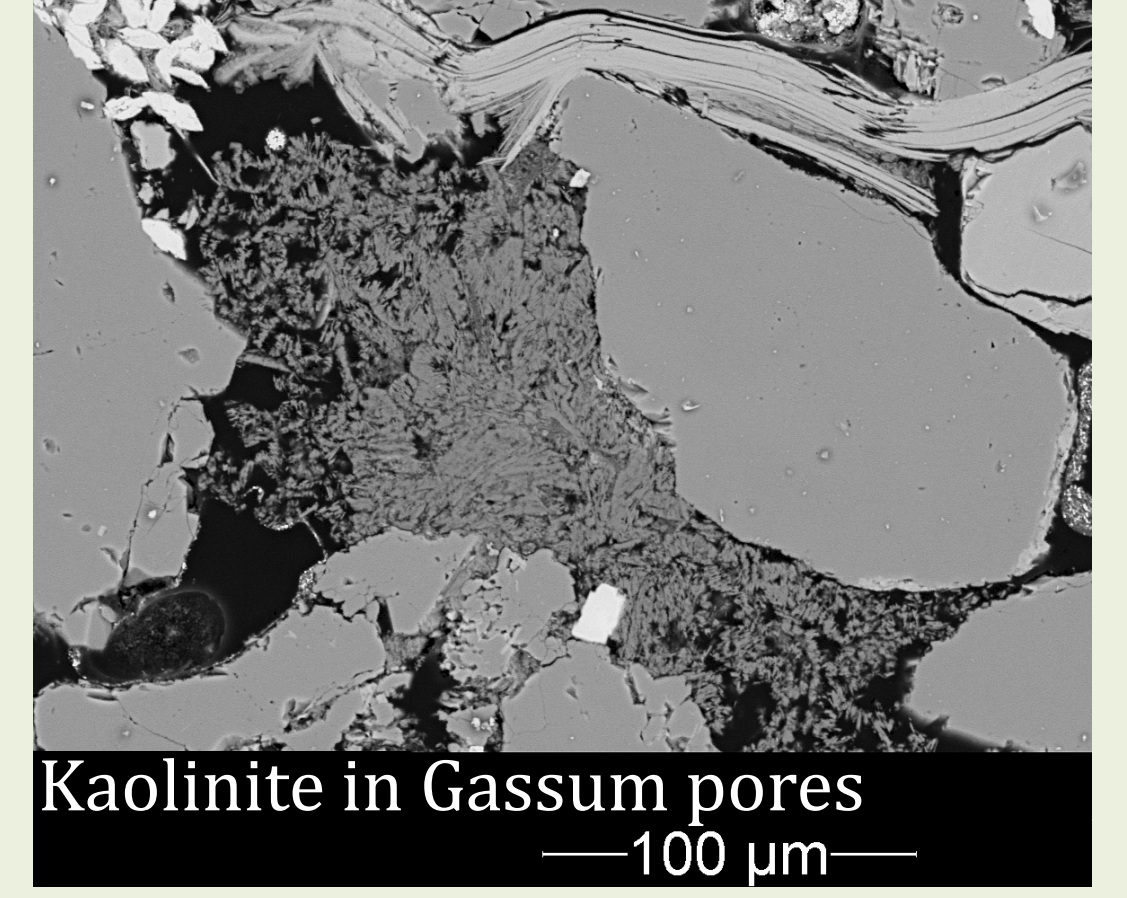
Naturally high pH



- A sharp permeability reduction was observed when flow rate was increased or salinity was reduced in the Berea sandstone [1,2,3].
- This is attributed to kaolinite mobilisation and pore plugging [1,2,3].

## Current study on Danish Gassum Formation

Naturally lower pH



- We find no sharp permeability reduction when flow rate is increased or salinity is reduced in the Danish Upper Triassic-Lower Jurassic Gassum Formation sandstone.
- This suggests no kaolinite mobilisation.

## Effect of pH and brine on kaolinite mobilisation

Kaolinite and quartz have a more negative surface charge at a high pH [4, 5].

The surface charge is shielded by ions that form an electrical double layer (EDL). The EDL is thin with brine when the ion concentration is high.

The net interaction energy is the sum of EDL repulsion and van der Waals attraction according to DLVO theory [6,7,8].

## Experiments on Gassum Formation

### Experimental Procedure

- Samples were tested first with formation brine, subsequently with water.
- The interstitial flow velocity was increased and subsequently reduced.
- Viscosity, density, pH, and electrical conductivity of effluent were measured.
- Permeability was calculated according to Darcy's law.

## Results and Discussion

**Permeability in the Gassum samples is higher with brine than distilled water.**

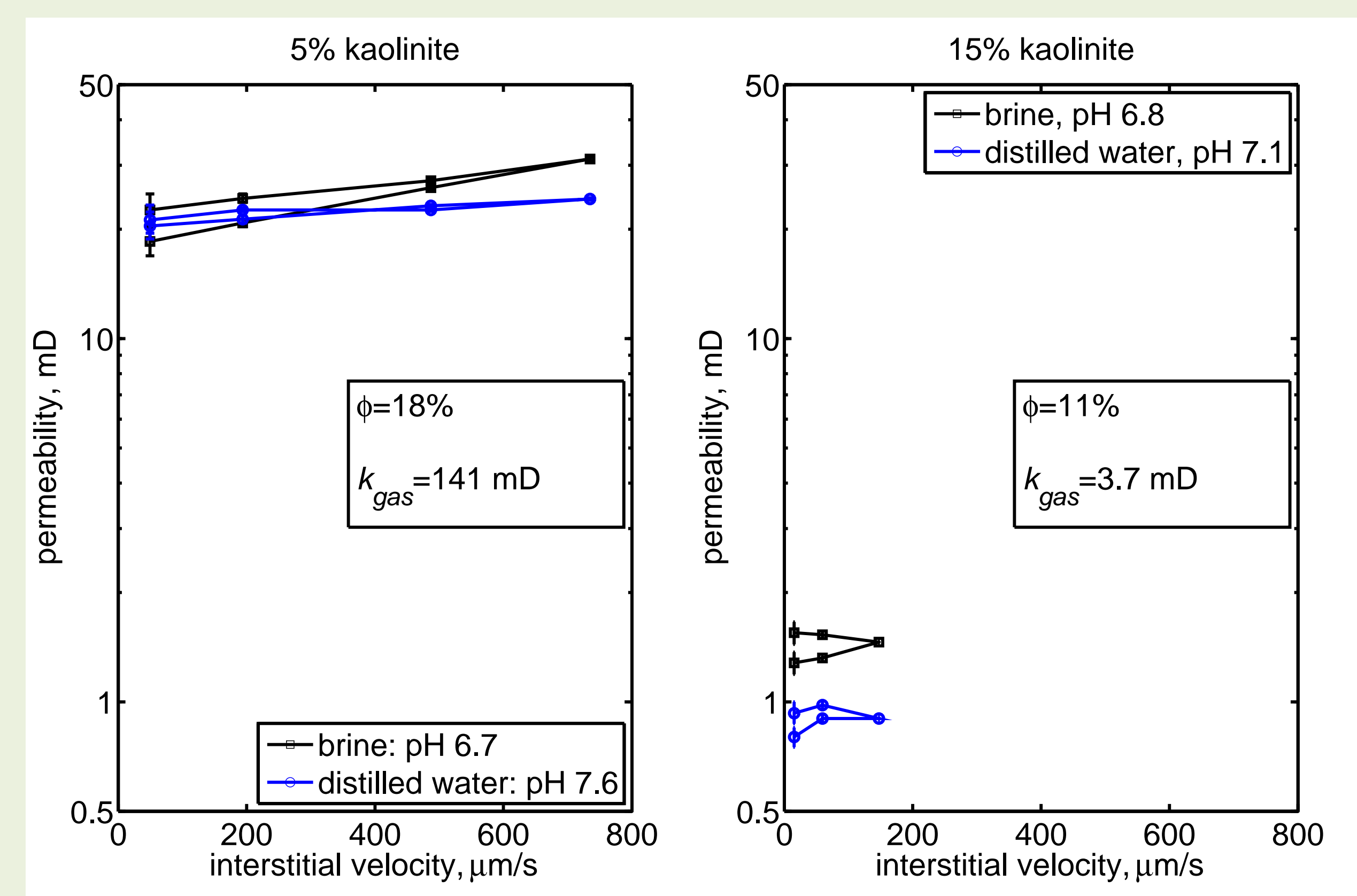
**The difference is greater in samples with more kaolinite.**

However, the difference is less than that reported for Berea sandstone.

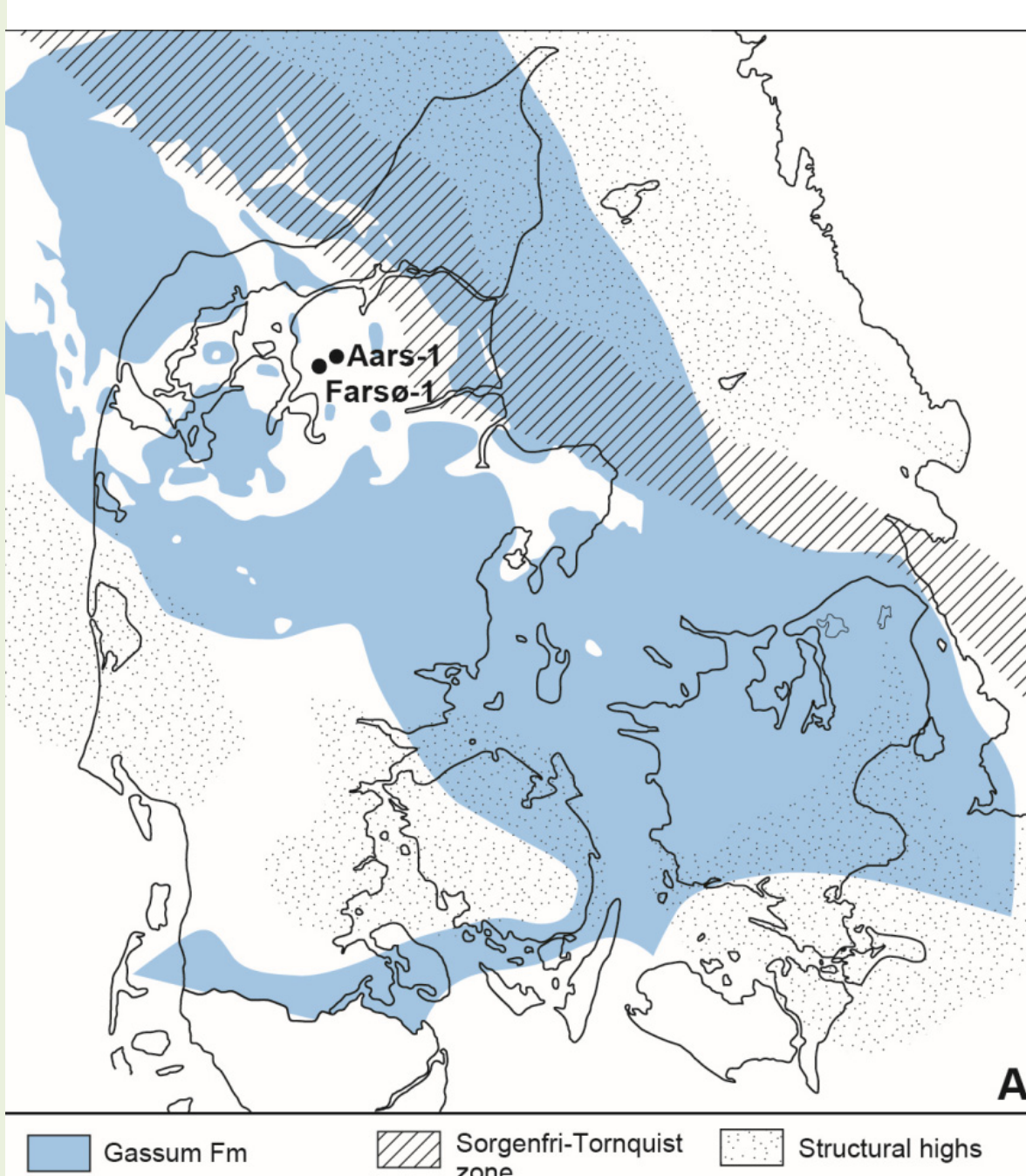
*If fluid in the EDL is immobilised this reduces effective porosity.*

**Increasing flow rate increases permeability in some Gassum samples, although no kaolinite is observed in the effluent.**

*Possibly hydrodynamic forces displace kaolinite from flow paths.*



## Gassum Formation in Denmark



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## Gassum Formation

